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भाग 2 आयाम ज्ञात करना

Indian Standard

METHODS OF TEST FOR WINDING WIRES

PART 2 DETERMINATION OF DIMENSIONS

(First Reprint APRIL 1999)

UDC 621·315·3 : 621·3·045 : ·006·78

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BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002

August 1993 Price Group 3

Winding Wires Sectional Committee, ETD 33

NATIONAL FOREWORD

This Indian Standard which is identical with IEC Pub 851-2 (1985), issued by the International Electrotechnical Commission was adopted by the Bureau of Indian Standards on the recommendation of the Winding Wires Sectional Committee (ETD 33) and approval of the Electrotechnical Division Council.

Methods of tests of enamelled round winding wires were earlier covered under IS 4800 (Part 3) and for rectangular and square enamelled copper conductors were covered under IS 3855 (Part 2). This new series of standards on methods of test for enamelled winding wires is being printed adopting IEC 851 series and would cover for enamelled round, rectangular and aluminium wires also. Standards for particular requirements of individual wires are also being brought out in line with IEC 317 series. With the publication of these series corresponding parts of IS 3855 and IS 4800 series would be withdrawn.

The text of IEC Standard has been approved as suitable for publication as Indian Standard without deviations. Certain conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

a) Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'.

b) Comma (,) has been used as a decimal marker while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

In this Indian Standard, IEC Pub 851-1 (1985) 'Methods of test for winding wires — Part 1 : General' is referred to. Read in its respective places IS 13778 (Part 1) : 1993 which is identical with the IEC standard.

Amendment No. 1 issued to IEC Pub 851-2 (1985) is given at the end.

Only English language text in the International Standard has been retained while adopting it in this Indian Standard.

In reporting the results of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'.

IEC
851-2

Amendment 1

Methods of test for winding wires

Part 2:
Determination of dimensions

Page 1

Modify existing 3.1.1 as follows:

3.1.1 *Round and rectangular wires*

The equipment used shall have an accuracy better than 2 µm. If a micrometer is used, it shall be ensured that the measuring force is within the range given in table 1. The diameter range of the spindle and anvil is also given in table 1.

Table 1 – Spindle/anvil diameters and measuring forces

Type of winding wire	Nominal conductor diameter mm	Spindle and anvil diameter mm	Measuring force N
Enamelled and tape-wrapped round wire	< 0,100	2 – 8	0,1 – 1,0
	≥0,100	5 – 8	1 – 8
Enamelled and tape-wrapped rectangular wire	—	5 – 8	4 – 10
Fibre-covered wire	—	5 – 8	4 – 10
Paper-covered wire	—	5 – 8	8 – 14

Page 3

Add, after 3.2.5, *the following new subclause:*

3.2.6 *Increase in diameter due to the bonding layer for round wires*

The overall diameter shall be determined according to 3.2.1 *a)*. The bonding layer shall then be removed by a solvent or other agent and in a manner which is agreed between purchaser and supplier. The overall diameter shall again be determined according to 3.2.1 *a)*.

The difference between the two mean values of the results of each measurement shall be reported as the "increase in diameter due to the bonding layer".

Increase in diameter due to the bonding layer may also be measured by any appropriate method as agreed between purchaser and supplier.

Indian Standard

METHODS OF TEST FOR WINDING WIRES

PART 2 DETERMINATION OF DIMENSIONS

INTRODUCTION

The reader is referred to the general introduction in I E C Publication 851-1: Methods of Test for Winding Wires, Part 1: General, which outlines the purpose of the new arrangement as indicated in the following table:

New arrangement without modification of the former texts

New sub-clause	Former clause	Former publication
3.1.1	4.1.2	251-1
3.1.2	4.1	251-2
3.2.1.1	4.2	251-1
3.2.1.2	4.2	251-3
3.2.1.3	4.2	251-2
3.2.2.1	4.3	251-1
3.2.2.2	4.3	251-3
3.2.3	4.4	251-1
3.2.4.1	4.5	251-1
3.2.4.2	4.5	251-3
3.2.5	4.4	251-3

1. Scope

This standard relates to: Test 4: Dimensions;

and groups the relevant texts previously laid down in the former I E C Publication 251.

2. Object

To standardize the determination of dimensions for winding wires.

3. Test 4: Dimensions

3.1 *Measuring equipment*

3.1.1 *Round and rectangular wires*

The measurement shall be made with an accuracy better than 2 µm. If a micrometer is used, it shall be ensured that the measuring force is in the range of 0.75 N to 1.25 N. The spindle and the anvil of the micrometer shall have a diameter of 5 mm to 8 mm.

Alternatively, for round wires with a nominal conductor diameter over 0.5 mm, a force of 1 N to 3 N may be used.

3.1.2 *Bunched wires*

The overall diameter shall be determined with a polished conical mandrel having dimensions as shown in Figure 1, page 10.

3.2 *Measuring method*

3.2.1 *Overall dimensions*

3.2.1*a)* *Round wires*

Three measurements shall be made evenly distributed around the circumference of the wire at each of two places 1 m apart.

The mean value of the six results shall be reported as "overall diameter".

3.2.1*b)* *Rectangular wires*

Measurements shall be made of both dimensions of the wire at three positions not less than 100 mm apart. The measurements shall be made on completely straight parts of the specimen.

Where the dimension of the specimen is greater than the diameter of the micrometer spindle, measurements shall be made both at the centre of the face of the specimen and over the edges. If the values differ, the highest value only shall be noted.

The mean values of the results for each dimension shall be reported as the "overall width" and "overall thickness".

3.2.1*c)* *Bunched wires*

Note. — The method indicated below gives useful values in practice but not an accurate overall diameter.

The overall diameter shall be determined by closely winding the bunched wire on the mandrel under a tension calculated according to the following formula:

Tension (in newtons) = 65 times the total nominal cross-section of the conductors (in square millimetres)

The width of the layer so formed shall be not less than 10 mm for bunched wires with nominal overall diameters up to and including 0.5 mm, and be not less than 20 mm for larger diameters.

The width shall be measured with an accuracy of 0.5 mm.

The width of the layer divided by the number of turns shall be the overall diameter of the bunched wire rounded off to 0.01 mm.

One measurement shall be made.

3.2.2 *Conductor dimensions*

3.2.2*a)* *Round wires**

The insulation shall be removed at two places 1 m apart by any method that does not damage the conductor.

Three measurements shall be made evenly distributed around the circumference of the conductor at the above two places.

The mean value of the six results for the bare diameter shall be reported as "conductor diameter".

---

* For determination of diameters in specification sheets, the following applies:

Nominal conductor diameter	Measurement	Clause
$d < 0.071$ mm	Resistance	3 (Publication 851-5)
$d \geq 0.071$ mm	Dimension	3.2.2*a)* (Publication 851-2)

Note. — By agreement between purchaser and supplier, resistance measurements may be made in the range of nominal conductor diameters between 0.071 mm and 1 mm.

3.2.2 *b) Rectangular wires*

The insulation shall be removed at the three positions used for measurements in Sub-clause 3.2.1 *b)* by any method which does not damage the conductor, and the conductor measured at these positions.

The mean value of the results for each dimension shall be reported as "conductor width" and "conductor thickness".

3.2.3 *Out-of-roundness of the conductor for round wires*

The out-of-roundness is defined as the greatest difference between the maximum and the minimum readings at each cross-section, as determined according to Sub-clause 3.2.2 *a)*.

3.2.4 *Increase in dimensions due to the insulation*

3.2.4 *a) Round wires*

The difference between the overall diameter, as determined according to Sub-clause 3.2.1 *a)* and the conductor diameter, as determined according to Sub-clause 3.2.2 *a)*, shall be reported as "increase in diameter due to insulation".

3.2 4 *b) Rectangular wires*

The difference between the overall width and the conductor width shall be reported as the "increase in width".

The difference between the overall thickness and the conductor thickness shall be reported as "increase in thickness".

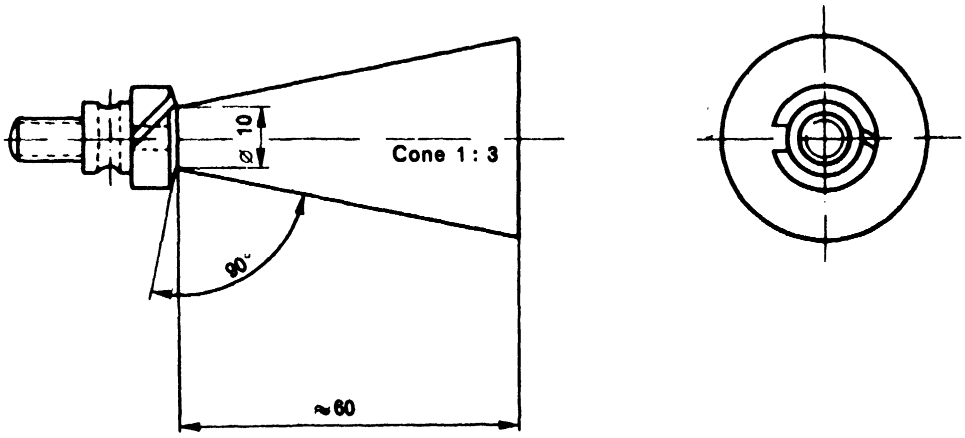
3.2.5 *Rounding of corners for rectangular wires*

This test is performed by preparing cross-sections of the wire and examining them under suitable magnification.

For this test, for example, the following method may be employed:

Three carefully straightened specimens, (straightening may be accomplished by stretching the specimen approximately 1 %) taken at least 200 mm apart, shall be cast in a suitable resin that will not affect the insulation. The resin shall have a colour which contrasts with the colour of the insulation.

After curing, the resin and the specimens shall be cut at right angles to the length of the specimen and carefully polished for examination under a sufficient magnification.



Dimensions in millimetres

FIG. 1. — Conical winding mandrel.

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